CLAIMS

1. A method of operating a bridge circuit comprising an input that receives a DC signal of voltage $+V_S$, an output having an electromagnet connected thereacross, first and second arms having first and second switches respectively, the first and second arms being connected to opposed ends of the electromagnet, the method comprising the steps of:

(a) receiving a voltage demand signal indicative of a desired voltage of an electrical signal to be supplied to the electromagnet in a period;

(b) generating first and second switching signals with reference to the voltage demand signal; and

(c) applying the first and second switching signals to the first and second switches respectively during the period;

wherein the switching signals cause the switches to switch between on and off states, switching between various combinations of on and off states of the first and second switches producing an electrical signal across the electromagnet with voltage pulses at levels of $+V_S$, 0V and $-V_S$,

the first and second switching signals being generated such that an average voltage of the electrical signal supplied to the electromagnet during the period is substantially equal to the desired voltage.

2. The method of claim 1 comprising the step of generating pulsed first and second switching signals.

3. The method of claim 2 comprising the step of generating the first and second switching signals according to a rule that the first and second switches are not switched concurrently.

4. The method of claim 2 or 3 comprising the step of generating the first and second switching signals according to a rule that the signals are to have no more than one pulse per period.

5. The method of claim 4 comprising the step of generating the first and second switching signals according to a rule that any pulse should be positioned substantially symmetrically about the centre of the period.

6. The method of claim 5 comprising the step of generating the first and second switching signals according to the rule that where pulses cannot be centred symmetrically, the longer and shorter sides of the asymmetric pulses are alternated between the leading edge side and the trailing edge side for successive pulses.

7. The method of any of claims 2 to 6 comprising the step of generating the first and second switching signals according to a pulse width modulation scheme.

8. The method of any of claims 7 comprising the step of generating the first and second switching signals according to a rule that the first switching signal should remain in one state throughout a period and the second switching signal contains a pulse such that the first switch remains in one state throughout a period and the second switch is switched between on and off states during the period.

9. The method of claim 8 comprising the step of generating the first and second switching signals according to a rule that the pulse widths of the resulting voltages across the electromagnet must not fall below a minimum pulse width.

10. The method of claim 9 comprising the step of generating the first and second switching signals according to a rule that pulse widths below the minimum pulse

width are avoided by departing from the rule that one of the first or second switches should remain in one state throughout a period with the other of the first and second switches being switched between on and off states during the period, in favour of a rule that both first and second switching signals contain a pulse such that both the first and second switches are switched between on and off states during a period.

11. The method of claim 10 comprising the step of adding the width of the pulse added to the second switching signal to the pulse of the first switching signal.

12. The method of any of claims 8 to 11, wherein the width of a pulse of the first and/or second switching signals is generated with reference to a voltage signal indicative of the DC signal such that the width of the pulse compensates for fluctuations in the DC signal.

13. The method of claim 12, wherein the voltage signal is passed through a filter to obtain a predictive measure of fluctuations in the DC signal.

14. The method of claim 13, wherein the voltage signal is passed through a finite impulse response filter.

15. The method of any of claims 8 to 14, wherein the width of a pulse of the first or second switching signals is generated to include additional width to compensate for a voltage drop across a diode and/or transistor in the bridge circuit.

16. The method of claim 15, wherein the additional width is calculated with reference to a current signal indicative of the current flowing through the electromagnet and a representative resistance of the diode or transistor.

17. The method of any of claims 8 to 16, wherein the width of a pulse of the first or second switching signals is generated to include additional width to compensate for a voltage offset caused by slow response times in the first or second switch.

18. The method of any of claims 2 to 17 further comprising the step of noise shaping the first and second switching signals.

19. The method of any preceding claim wherein the first and second switches are transistors and the method comprises the step of switching the transistors between on and off states corresponding to substantially maximum and substantially minimum current flow respectively through the transistors.

20. The method of any preceding claim comprising the step of receiving a current demand signal indicative of a desired current to be supplied to the electromagnet in a period and determining the voltage demand signal indicative of a desired voltage of an electrical signal to be applied to the electromagnet that results in the electrical signal being supplied to the electromagnet during the period with a current substantially equal to the desired current.

21. The method of claim 20, wherein the step of calculating the voltage demand signal is performed with reference to a model of the load characteristic the electromagnet.

22. The method of claim 20 or claim 21 further comprising the step of generating the voltage demand signal with reference to a current signal indicative of the current flowing through the output.

23. A computer program comprising program code means for performing the method steps of any of claims 1 to 22 when the program is run on a computer and/or other processing means associated with the bridge circuit.

24. A computer program product comprising program code means stored on a computer readable medium for performing the method steps of any of claims 1 to 22 when the program is run on a computer and/or other processing means associated with the bridge circuit.

25. A bridge circuit comprising an input operable to receive a DC signal of voltage $+V_S$, an output having an electromagnet connected thereacross, first and second arms having first and second switches respectively, the first and second arms being connected to opposed ends of the electromagnet and processing means programmed to perform the method steps of any of claims 1 to 11, 17, 20 or 21.

26. A bridge circuit according to claim 25, further comprising voltage signal sensor operable to produce a voltage signal and wherein the processing means is programmed to perform the method steps of claim 12.

27. A bridge circuit according to claim 26, further comprising a filter arranged to receive the voltage signal.

28. A bridge circuit according to claim 27, wherein the filter is a finite impulse response filter.

29. A bridge circuit according to any of claims 25 to 28, further comprising a diode and/or transistor and wherein the processing means is programmed to perform the method steps of claims 15 or 19.

30. A bridge circuit according to claim 29, further comprising a current signal sensor operable to produce a current signal and wherein the processing means are programmed to perform the method steps of claims 16 or 22.

31. A bridge circuit according to any of claims 25 to 30, further comprising a noise shaper operable to noise-shape the first and second switching signals.

32. A method of operating a bridge circuit substantially as hereinbefore described with reference to any of Figures 1 to 6.

33. A bridge circuit substantially as hereinbefore described with reference to any of Figures 1 to 6.